ENVIRONMENTAL CONDITIONS OF THE NORTH-EAST CASPIAN SEA

The Caspian Sea

Current Environmental Issues of the North Caspian Sea

- Control of the river inflow
- Long-term cyclic fluctuations of the sea level
- Chemical pollution of the sea (river inflow, sewage water from enterprises and settlements located on the coast, washing off pollutants from the coast with wind surges and long-term activities related to oil exploration and production)
- Invasion of alien organisms;
- Regular death of seals caused by various reasons including climatic changes
- Reduction of fish stock, including valuable fish species, caused by a number of factors: illegal fishing, increase of anthropogenic pollution, control of river inflow, sea level fluctuations.

Geology

- the ancient pre-caspian syneclize in the north and the epi-hercynian Turanian plate in the south
- The northern part of the Turanian plate in the shelf - a series of small uplifts, altogether called as the Kulalinsky ridge.
- The thickness of the **Pliocene**- Quaternary, predominantly terrigenous deposits, is characterized as a complex structure due to a frequent alteration of continental and marine conditions in the major part of the North Caspian Sea.
- The thickness of the **Pleistocene** does not exceed 100–200 m here. Novokaspiysk, Mangyshlak, Upper Khvalynskiy and Lower Khvalynskiy horizons were found in the Quaternary deposits in the North Caspian Sea.

The following transgressions were established:

- Baku (400–500 thousand years ago),
- Early Khazar (more than 250 thousand years ago),
- Late Khazar (90–130 thousand years ago),
- Early Khvalyn (35–65 thousand years ago),
- Late Khvalynian (10–20 thousand years ago)
- and Novocaspian, which had three peaks (8, 6,
- 2.5 thousand years ago).

Lithological and stratigraphic description

- Lower Permian evaporites (Kungurian stage)
- upper (post-salt) — Mesozoic-Cenozoic and
- lower (pre-salt) — Paleozoic
- The Upper Devonian deposits - organogenic limestones
- The post-salt structural layer – with packs of carbonate rocks
- Undifferentiated Permo-Triassic deposits - brownish and red clay stone and argillites, sandstones and clay stones, as well as limestone layers.
- The Upper Triassic - gray and gray-green siltstones with interlayers of sandy siltstone
- Jurassic deposits - terrigenous and carbonate sediments
- Deposits of the Paleogene and Neogene systems - imestones, interbedded sands, sandstones, siltstones and thin layers of gypsum.
- Quaternary deposits - sandy, silty rocks of the Novocaspian layer, underlain by dense gypsum clays of greenish-gray color with spots of iron oxides

Seismicity

- According to the seismic zoning map of the Atyrau region [Seismic zoning, 2003], the water basin where EP offshore facilities are located refers to the 5–point seismic zone based on MSK–64 scale.

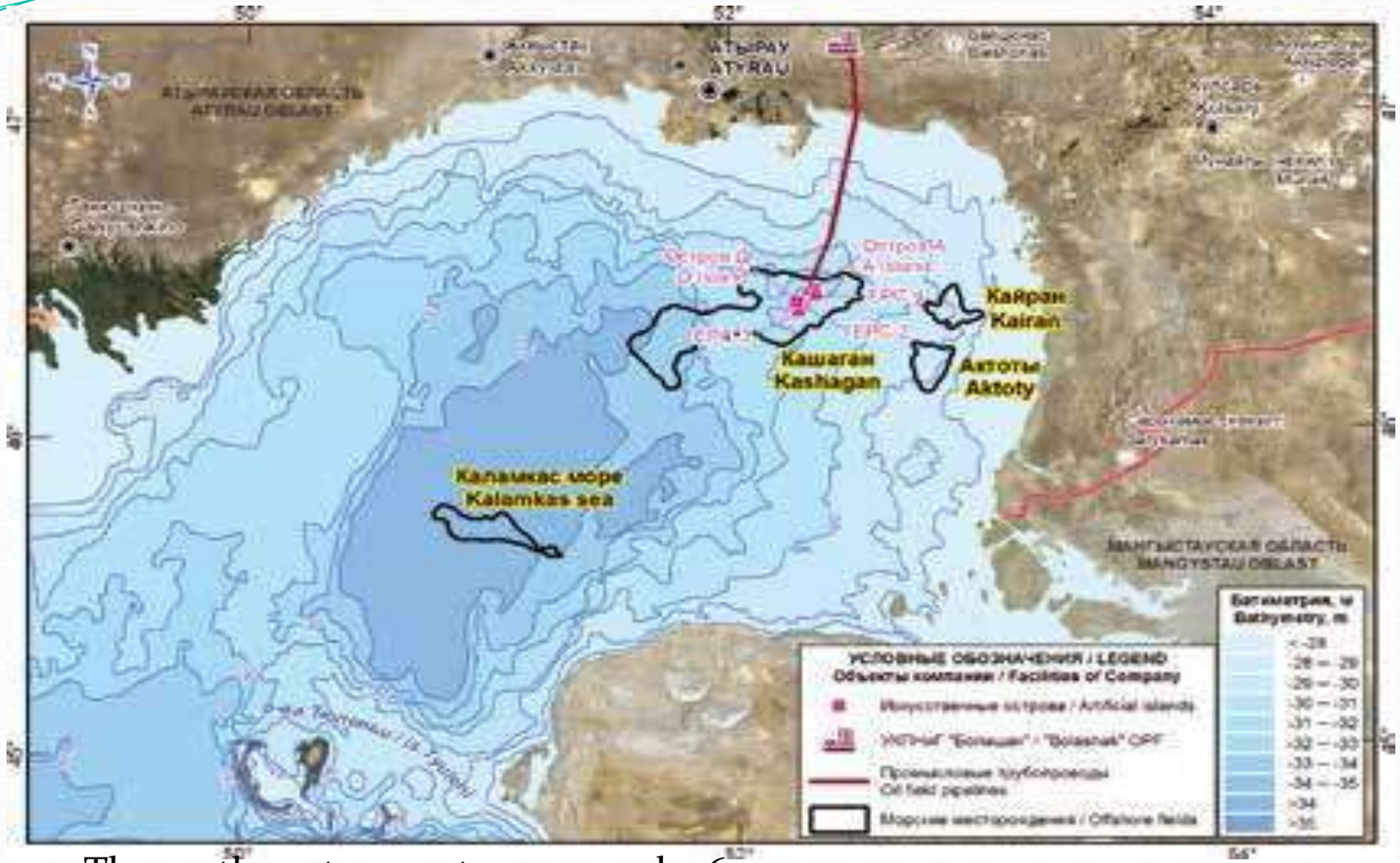
Geomorphology of the Seabed

- Alluvial-marine plain of the coastal seaside (avandelta)
- A flat transition zone with a continuation of water streams of the amphibious state with hydrophilic vegetation
- The outer, sloping strip of the alluvial-delta plain is characterized by an increased incline, crushed sediments, giving way to the strongest water streams.
- The sea plain developed by downward currents occupies the shallowest coastal parts of the water basin.
- The sea plain formed by currents and wave disturbances occupies a major part of the sea bed.
- The sea plain with islands and shoals of complex origin is located to the west of the Bozaschy Peninsula and corresponds
- In different periods of the late Pleistocene and Holocene the shelf of the North- East Caspian Sea became land and some elements of its relief have subaerial features.

Shores

- Low-lying shores: the eastern part of the Volga delta, the intercoastal part of the Volga-Ural interfluve, the delta shore of the Zhaiyk river, low-lying dry shore from the Zhaiyk river delta to the lower reaches of the Zhem river (Emba river), the sors of Dead Kultuk and Kaidak, mostly dried shores of the Bozashchy peninsula, etc.
- The raised shores: the Tupkaragan peninsula, abrasion shores with an active cliff to the south of the Kuryk village, to the north of the Kazakh Bay and along the Kendirli- Kayasan plateau.

Bathymetry

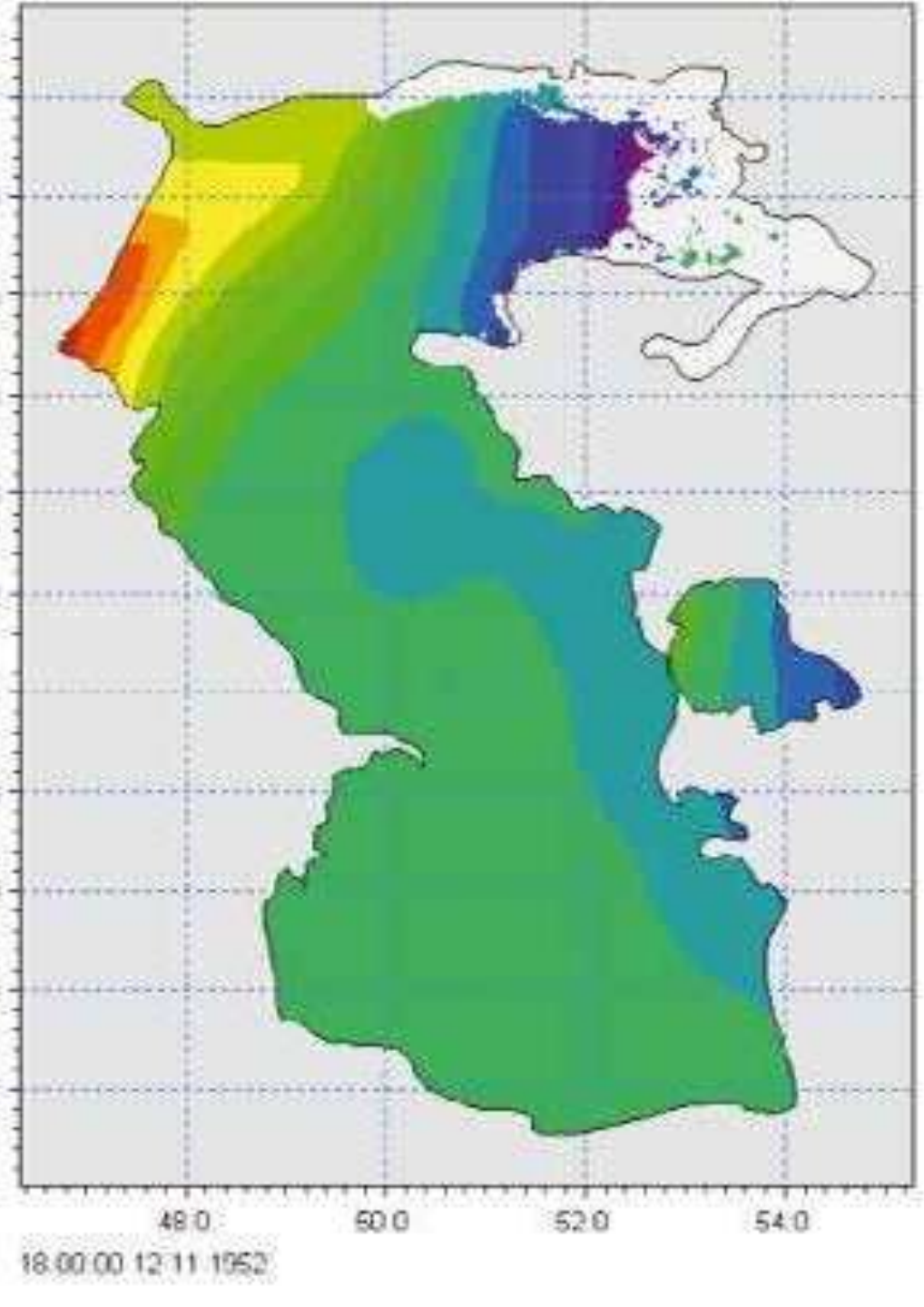


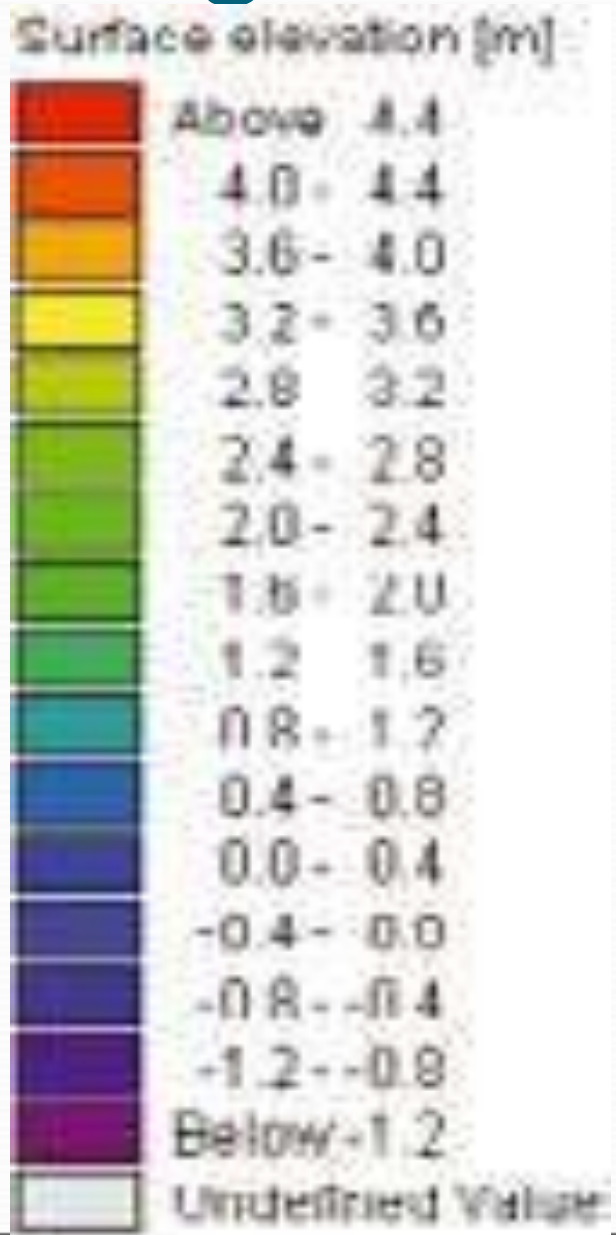
- The north-eastern part - 3.3 m and 5.6 m
- The western part - 0–5 m
- The western part of Kashagan field- 6.4–8.0 m
- Kashagan East- 3.1–4.8
- Kalamkas-Sea field - up to 9.0–10.0 m

Sea Level


1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016
-26,6
-27
-27,2
-27,4
-27,6
-27,8
-28
Sea level (Kazgidromet, KASPKOM)
Sea level (Kashagan)

Surges


48.0
50.0
52.0
54.0
18:00:00 12 11 1952


Surface elevation [m]
Above 4.4
4.0 - 4.4
3.6 - 4.0
3.2 - 3.6
2.8 - 3.2
2.4 - 2.8
2.0 - 2.4
1.6 - 2.0
1.2 - 1.6
0.8 - 1.2
0.4 - 0.8
0.0 - 0.4
-0.4 - 0.0
-0.8 - -0.4
-1.2 - -0.8
Below -1.2
Undefined Value

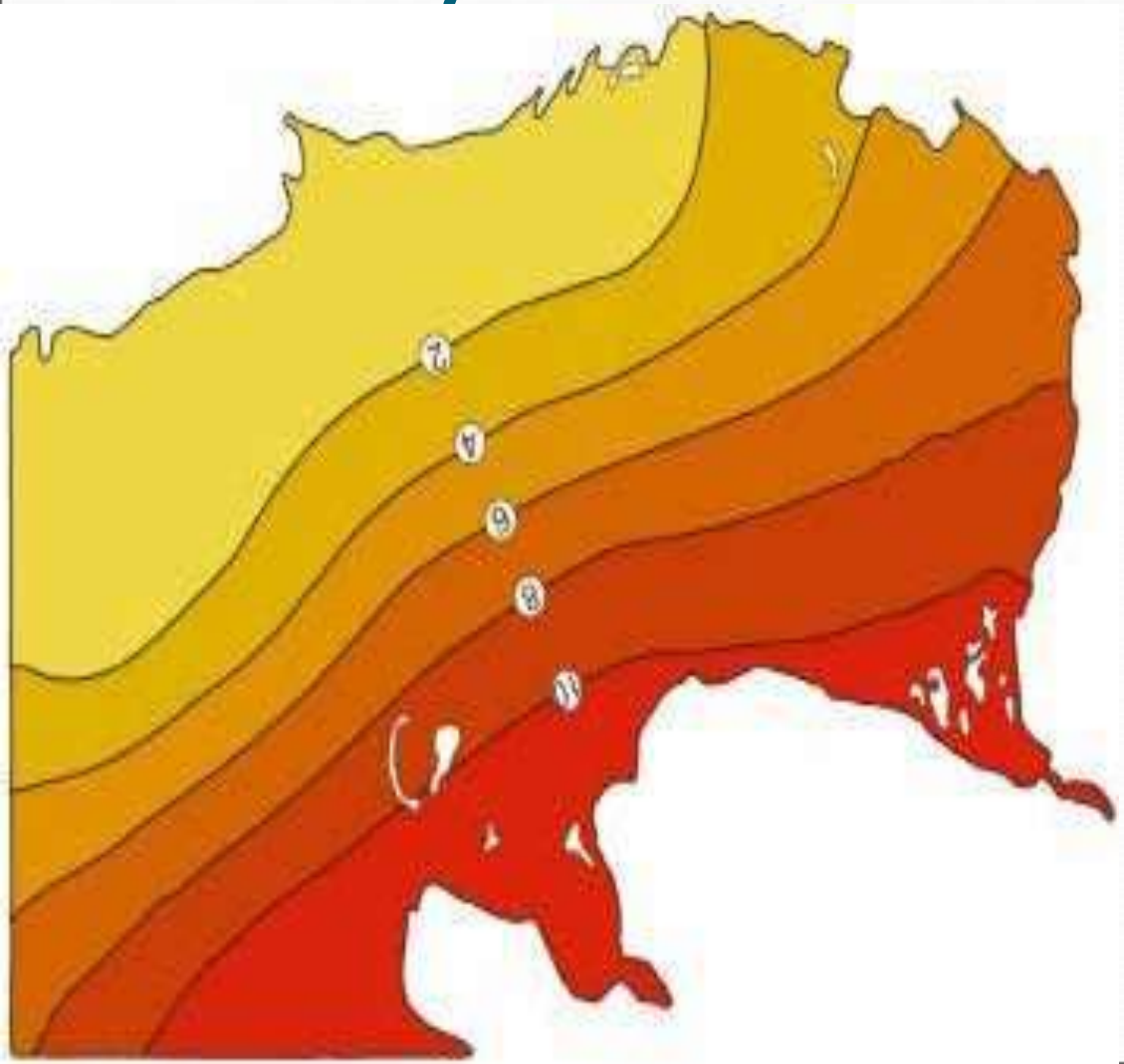
Wind-Induced Waves

- less than 0.5 m is 58.6%;
- 0,5–1,0 m — 27,5%;
- 1,0–2,0 m — 13%;
- 2,0–3,0 m — 0,8% and
- More than 3,0 m — 0,1%.

Water Temperature

- The average annual temperature of surface water layer in the Caspian Sea is 11–12 °C.
- In summer (July), average monthly surface temperatures of 24–25 °C prevail in the Caspian Sea

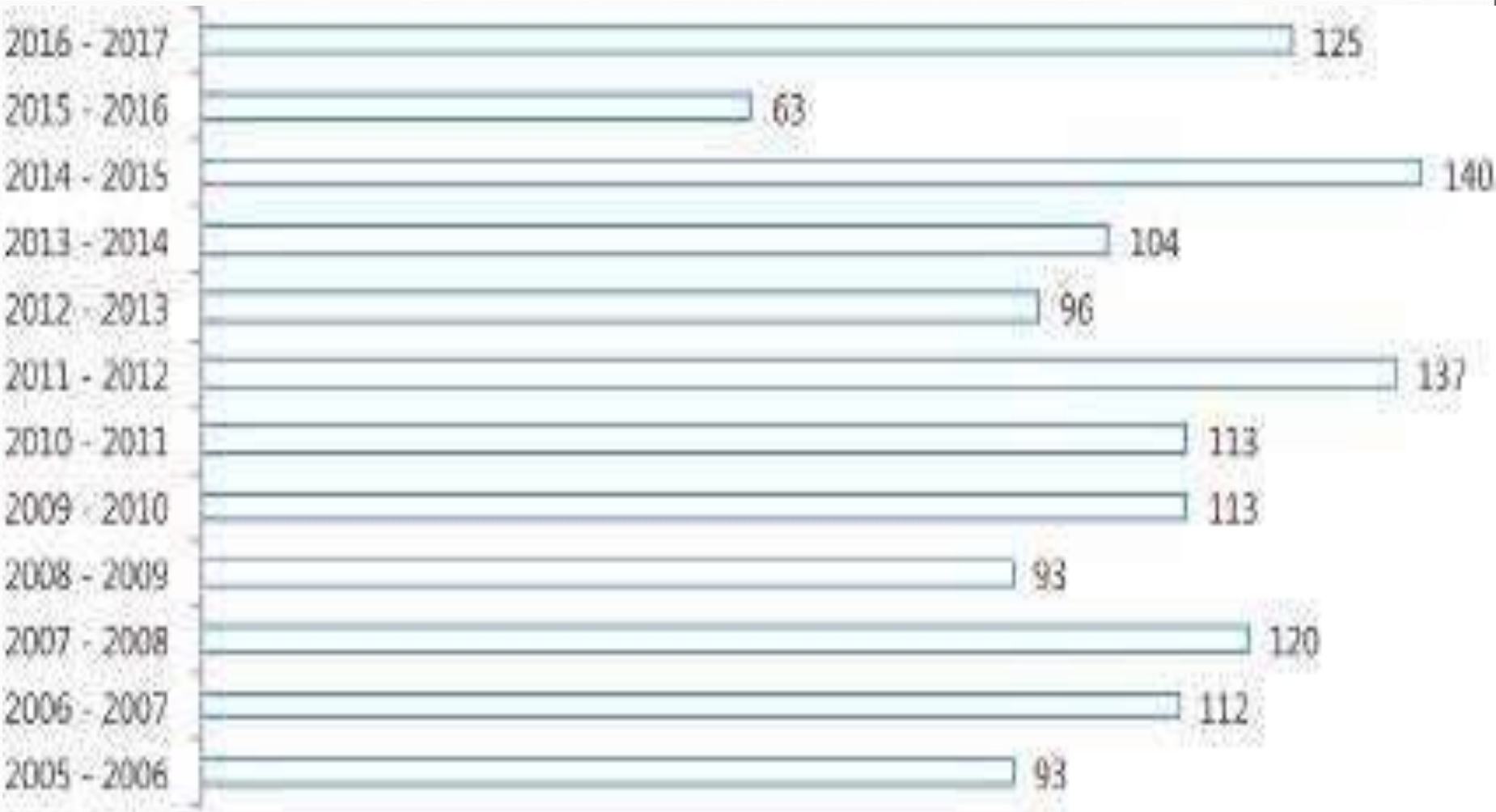
Salinity



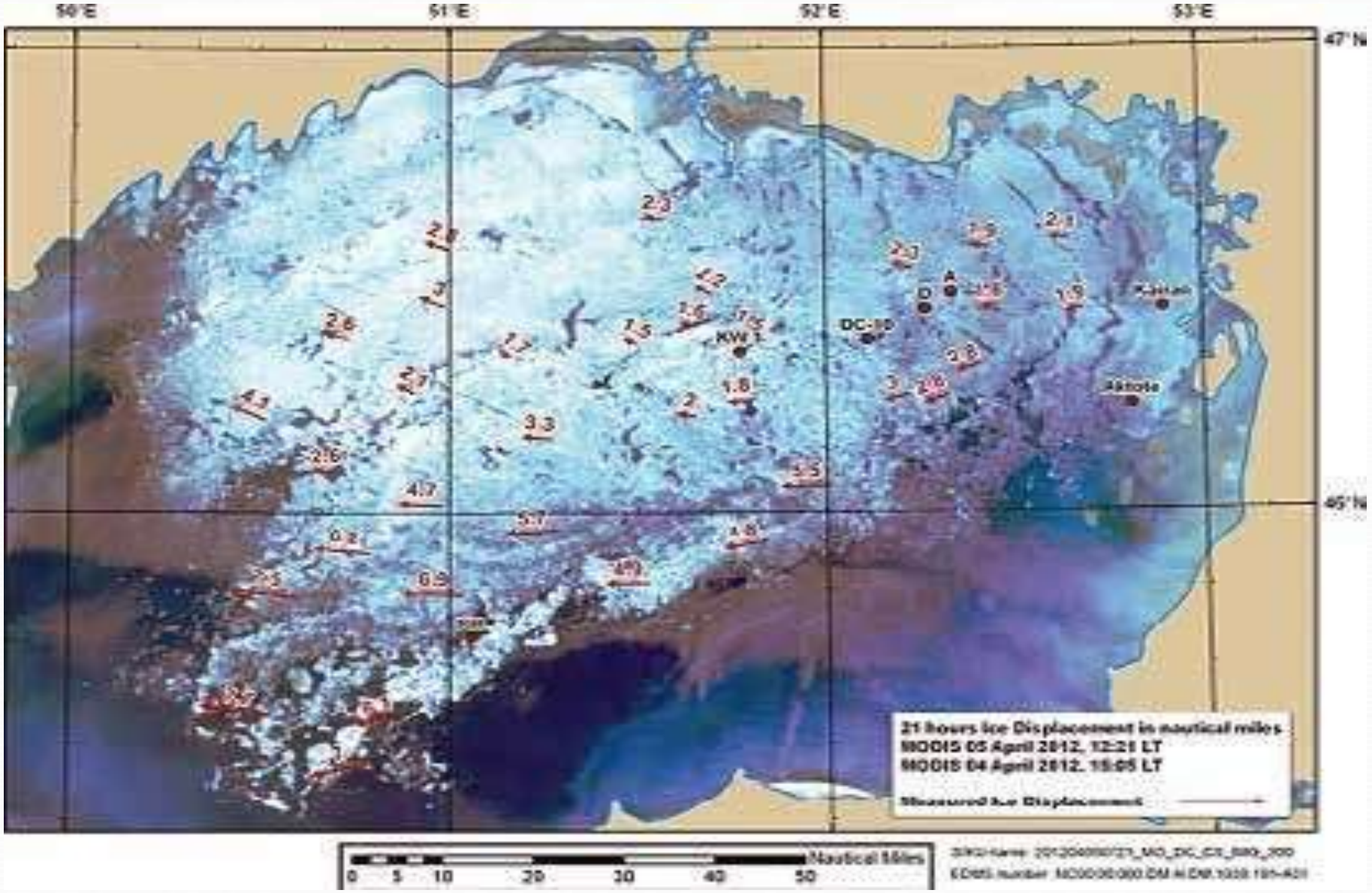
- More
- 10
- 8
- 6
- 4
- 2
- less

Currents and Circulation of Water

Ice Conditions



Ice Dynamics



Statistical Characteristics of Ice Hummocks Heights, Meters

Parameters	Bautino-Kalamkas-Sea area	Kashagan West	Kashagan East
Average value	0,63	0,64	0,51
Lowest value	0,00	0,10	0,00
Highest value	4,00	4,00	4,00
Standard deviation	0,55	0,52	0,51
Number of Observations	2330	2322	2478

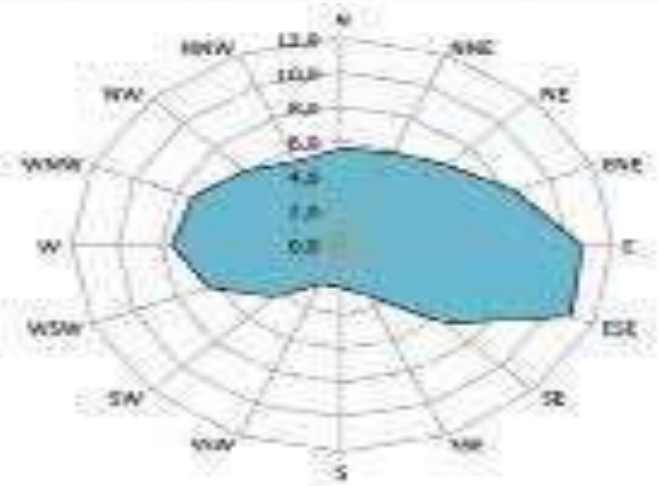
Climate

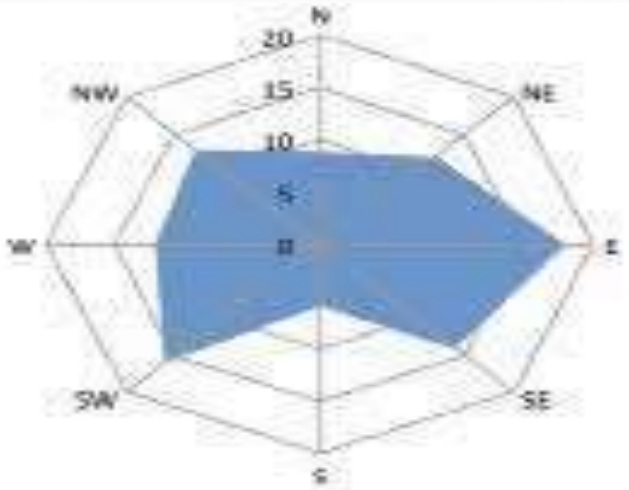
Spring	15-25 March
Summer	15–20 May
Autumn	20–30 September
Pre-winter season	25 October–5 November
Winter	30 October–10 November

Solar radiation

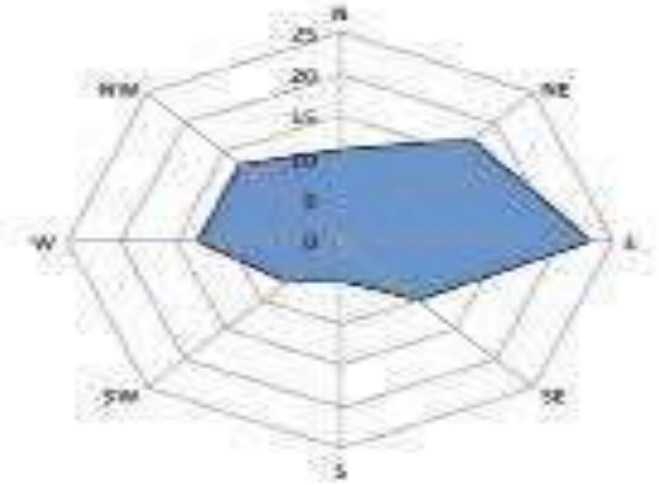
- The average annual duration of sunshine in Atyrau is 2,635 hours. The total solar radiation over the North Caspian Sea is 111–120 kcal/cm2.

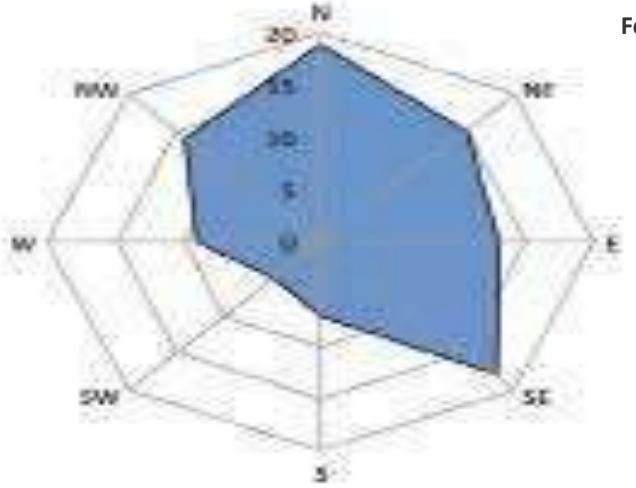
Wind Direction and Speed





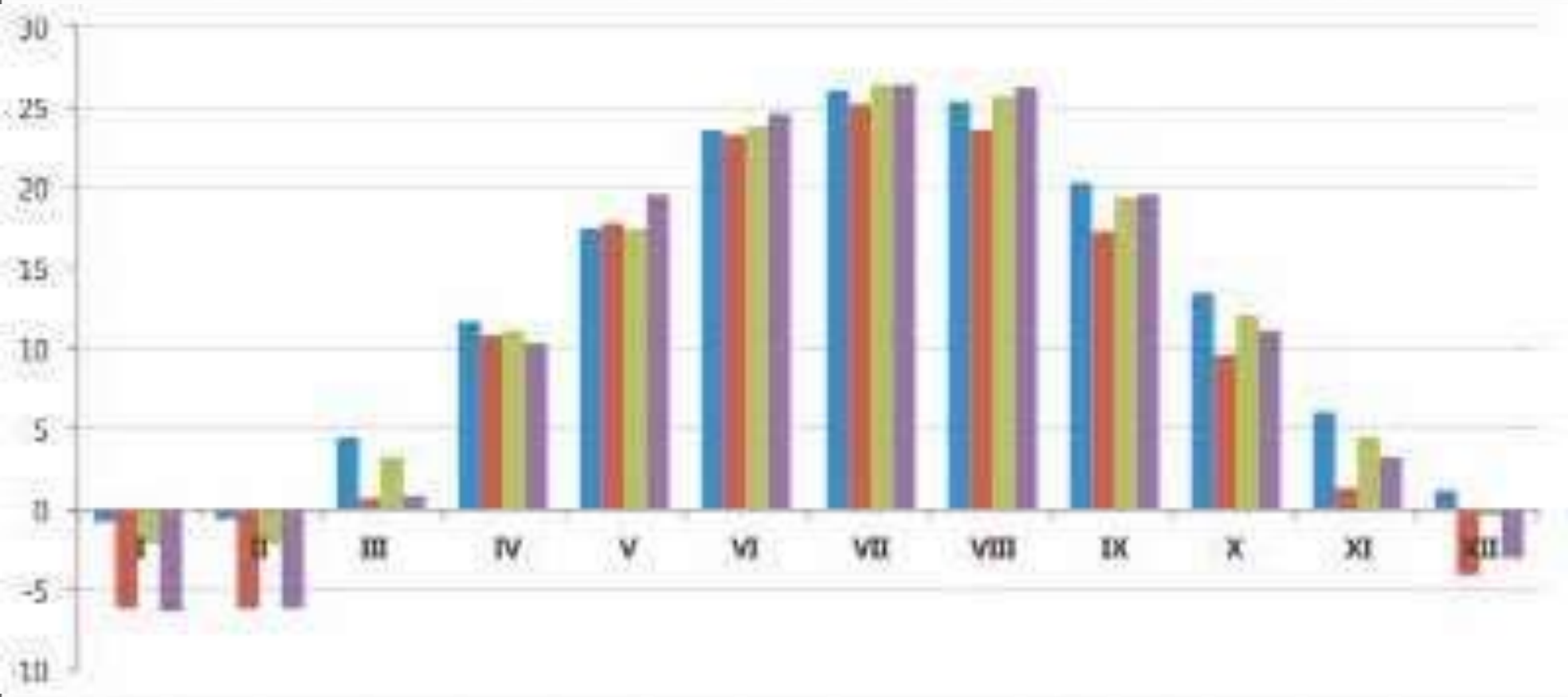
Peshnoi



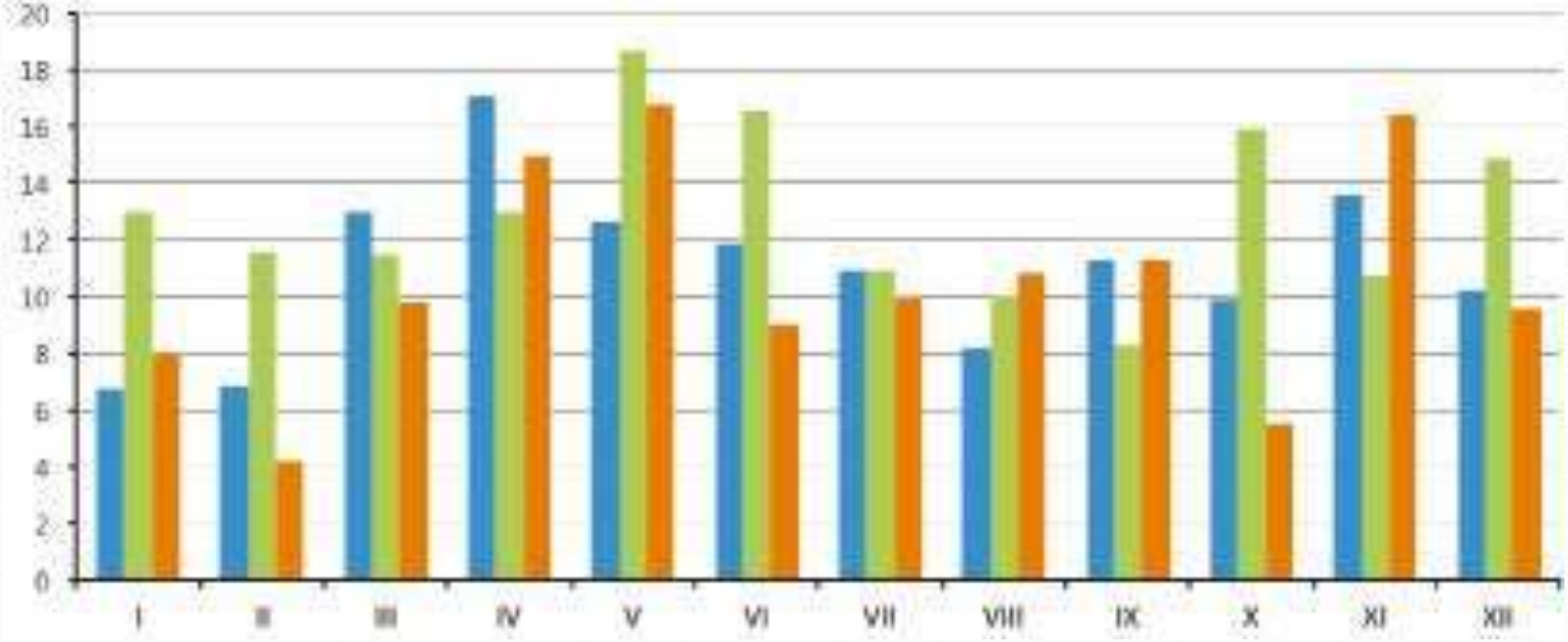


Fort Shevchenko

Air temperature



Humidity and Atmospheric Precipitation



Entry of Contaminants into the North Caspian Sea